M.Sc. Industrial Mathematics

Scheme of teaching and examination

**Semester – I**

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<td>IM – 101</td>
<td>Real Analysis</td>
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<td>IM – 102</td>
<td>Ordinary Differential Equations</td>
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<td>Advanced Numerical Techniques</td>
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<td>IM – 106</td>
<td>Programming Language</td>
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<td>Partial Differential Equations</td>
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<td>Functional Analysis</td>
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<td>Numerical Linear Algebra</td>
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<td>Design and Analysis of Algorithm</td>
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<td>Object Oriented Programming with C++</td>
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<td>Applied Statistics</td>
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<td>Integral Equation</td>
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<td>Optimization</td>
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<td>Fluid Dynamics</td>
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<td>Modeling and Simulation</td>
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<td>File Organization and Database Systems</td>
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<td>Neural Network</td>
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Prerequisite
The extended real numbers, sequences of real numbers, open and closed sets of real numbers
axioms for the real number, continuous functions, borel sets.

Lebesgue measure
Introduction, outer measure, measurable sets and lebesgue measure, non measurable sets,
measurable function, littlewood’s three principles.

Lebesgue integral
Riemann integral, lebesgue integral of a bounded function over a set of finite measure, integral
of a non negative function, general lebesgue integral

Differentiation and integration
Differentiation of monotone functions, functions of a bounded variation, Differentiation of an
integral, absolute continuity, convex functions.

Measure and integration
Measures spaces, measurable functions, integrations, general convergence theorem, signed
measures, the Random – Nikodym theorem. The $L^p$ – Spaces.

Measures and outer Measures
Outer measures and measurability, the extension theorem, the lebesgue Stieltjes iintegral,
Product measure, integral operators, caratheodory outer measure, hausdroff measure

References:
Mathematical modeling by means of ordinary differential equations

Reduction of nth order equation into first order systems


Phase plane Analysis

Linearization of nonlinear systems

Autonomous and nonautonomous Linear system Theory: Linear Dependence and independence of solution, Wronskian.

Transition matrix (fundamental matrix) for a linear system, solution of a nonlinear system by variation of parameters method, computation of transition matrix, eigenvalue method, Peano-Backer series method.

Discrete dynamical systems

Stability of dynamical systems, Lyapunov, exponential and asymptotic stability and their characterization.

Sturm-Liouville equations, Eigenvalue problems

Series solution of non-autonomous systems, Bessel and Legendre series, Frobenius method.

Reference Books:

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

IM 103: Linear Algebra

Syllabus to be offered at M. Sc. Industrial Mathematics Sem - I w.e.f. June 2010-11

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Linear operator

Functions linear operators, null space and range, rank and nullity theorem, operator inverses, application to matrix theory, computation of null space and range of a matrix, matrix of an operator, change of basis and similar matrices.

Inner product spaces

Basics of inner product space, orthogonal sets fourier coefficients and partial identity gram-schmidt process QR factorization, approximation and orthogonal projection, equivalence of the problems, normal equations projection operators, orthogonal complements, applications to an approximations and matrix theory fredholm alternative theory, matrix representation of an inner products, orthogonal change of bases, rank of gram matrix

Diagonalizable linear operators

eigen values and eigen vectors, spectrum and eigen spaces of an operator, thoritical computation using determents, property of the characteristic polynomial, geometric and algebric multiplicity, diagonalizable operator and their computational advantages, similarity to a diagonal matrix, function of a diagonalizable operator, function of matrices, general properties of function of diaglionalization operator, minimaul polynomial, first order matrix differential operator, decoupling the differential eauation, estimates of eigen values, gershgorin’s theorem

References:

2. S. Biswas, Matrix Algebra, new age int. pub. 2nd ed. 1997
IM 104: Advanced Numerical Techniques

Syllabus to be offered at M. Sc. Industrial Mathematics Sem - I w.e.f. June 2010-11

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- Computer Arithmetic: Floating point numbers and round off errors, Absolute and relative errors.
- Polynomial Interpolation: Hermite's interpolation formula with error analysis, Richardson interpolation, splines and spline interpolation, Aitken extrapolation
- Numerical differentiation, Gaussian quadrature, Romberg integration, adaptive quadrature
- Solution of system of Linear equations:
  - The LU and Cholesky factorizations
  - Pivoting and constructing an algorithm based on Gaussian elimination method
  - Solution of equations by iterative methods (Jacobi’s method, Gauss-Seidel method)
  - Steepest descent and Conjugate gradient methods.
- Algebraic Eigen value problem:
  - Properties of eigen values and eigen vectors
  - Power method
  - Inverse power method
  - Jacobi's method, Given's method
  - Schur and Gershgorins theorem
  - Orthogonal factorization
  - QR algorithm for eigen value problem
  - Eigen values of complex matrix and complex eigen vectors
- Approximation:
  Different types of approximation, Least square polynomial approximation, Polynomial approximation by use of orthogonal polynomials, approximation with Chebyshev polynomials.
- System of non linear equations: Newton Raphson’s method

Reference Books:

IM 105: Mechanics

Syllabus to be offered at M. Sc. Industrial Mathematics Sem - I w.e.f. June 2010-11

FUNDAMENTALS OF PHYSICS

- Measurement
- Motion in one dimension: Displacement, Velocity, Acceleration, Equation of motion with constant acceleration.
- Motion in two dimension and three dimensions: Displacement, Velocity, Acceleration, Projectile Motion, Uniform circular motion, Relative motion in two and three dimension
- Newton Laws of motion (with examples), Friction and centripetal forces
- Kinetic energy and work, Work done by weight, Work done by variable force, Work-kinetic energy theorem, Work done by spring force, Power, Potential energy and conservation of energy, Electric potential energy, Gravitational potential energy, Conservation of energy
- System of particles: Newton Laws for system of particle, Linear Momentum and Newton's second Law, Conservation of linear momentum, collision, Impulse and linear momentum, Elastic and Inelastic collision in one dimension, Collision in two dimension
- Rotational motion: Angular displacement, Angular velocity and Angular acceleration, Equation of motion for constant angular acceleration, Torque, Newton second law in angular form
- Elasticity
- Planets and satellites: Kepler’s law

Oscillations and wave theory

- Oscillations: Energy, SHM, Energy in SHM, damped simple harmonic motion, forced oscillations and resonance, Simple pendulum
- Waves: Types of waves, wavelength, frequency, period, angular frequency, Superposition of waves
- Sound waves: Doppler effect

Heat and Thermodynamics

- Thermodynamics : Zeroth Law of Thermodynamics
- The Celsius, Kelvin and Fahrenheit scales
• Thermal expansion: Linear expansion and volume expansion
• Specific heat
• First law of Thermodynamics
• Conduction, convection, radiation
• Kinetic theory of Gases and second law of Thermodynamics: Ideal gases, Internal energy, the Adiabatic expansion of an ideal gases, Entropy, Second law of thermodynamics, Entropy in the real world, Engines, Refrigerators

• Electromagnetism
  • Electric charge, Conductors and insulators, Coulomb’s law.
  • Electric field, Electric field due to a point charges, Electric field due to an electric dipole, Gauss law.
  • Electric Potential, Equi-potential surfaces, Calculation of Potential from field, Potential due to a point charge
  • Capacitors, Capacitance, Capacitors in series and parallel, Capacitor with a Dielectrics.
  • Moving charges and electricity, Currents, Semi conductors, Super conductors., Electric current, Current density, Resistance and Resistivity, Ohms law.
  • Circuits: Work, energy, emf, power, Ameter and voltmeter, RC circuits, Kirchoff's law
  • The Magnetic field, definition of B, Hall effect, Torque on a current loop, Magnetic dipole.
  • Magnetic field due to current, Amperes law, solenoids.
  • Faraday’s law, Lenz’s law, Inductance and inductors, self inductance, RL circuits, energy stored in magnetic fields
  • Maxwell’s equations: magnetic moments, magnates, Paramagnetism, diamagnetism, ferromagnetism, Maxewell’s equations
  • Geometric optics : Plane mirrors, spherical mirrors, thin lenses
  • Wave optics : Interference and diffraction.

Reference Books:
1. D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics, Sixth edition,
2. J.B. Serway, Fundamental of Physics
IM 106: Programming Language

Syllabus to be offered at M. Sc. Industrial Mathematics Sem - I w.e.f. June 2010-11

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Introduction
- Algorithms and Flowchart, Types of Languages, Introduction to C Language

C Fundamentals
- Identifiers, Data Types, Constants and Variables, Arrays

Operators and Expressions
- Arithmetic Operators, Unary Operators, Relations Operators, Logical Operators
- Assignment Operators, Conditional Operators, Library Functions, Expressions, Evaluation of Expression

Data Input and Output
- Single Character input and output, The scanf function, The printf function, Gets and Puts functions

Control statements
- The While Statement, do-while statement, for statement, if – else statement, switch statement, break statement, continue statement, goto statement

Functions
- Introduction to functions, Function definition, Accessing function, Passing arguments to function, Recursive function

Arrays
- Defining an array, Processing an array, Multi dimensional arrays, Passing array to a function, Arrays and Strings

Structures and Unions
- Defining a structure, Processing a structure, Unions

Reference Books
1. C programming Language – karnighan & Ritchie – TMH
2. ‘C’ Odyssey 6th Volume – Vijay Mukhi – PHI
4. Mastering turbo C- Kelly and Bootle – BPB
5. C language Programming Byron Gottfried – TMH
Basic of complex Numbers:

Analytic Functions:
Functions, limits and continuity, differentiability, Power series as an analytic function, Exponential and Trigonometric functions, Complex logarithms, Inverse functions, Zeros of analytic functions.

Complex Integration:
Curves in the complex plane, Basic properties of complex integral, winding number or index of a curve, Cauchy-Gaursat Theorem, Homotopy version of Cauchy's theorem, Morea's theorem, Cauchy Integral Formula, Laurent series, The maximum modulus principle, Schwartz's lemma, Liouville's theorem.

Singularities:
Isolated and non-isolated singularities, removable singularities, poles, singularities at infinity, Analytic continuations.

Residues and evaluation of certain integrals:
Residue at a finite point, residue at a point at infinity, residue theorem, no of zeros and poles, Rouchae’s theorem, integrals of type \( \int_{\alpha}^{2\pi} R(\cos \theta, \sin \theta) \, d\theta \), integrals of type \( \int_{-\infty}^{\infty} f(x) \, dx \), integrals of type \( \int_{-\infty}^{\infty} g(x) \cos(mx) \, dx \), singularity in real axes, more on using rectangular curves, estimation of sums.

References:
IM 202: Partial Differential Equations
Syllabus to be offered at M. Sc. Industrial Mathematics Sem - II w.e.f. June 2010-11

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- Introduction to PDE, Modelling Problems related to PDE.
- General PDE, Classification of PDE - hyperbolic, elliptic and parabolic PDE
- Boundary conditions, well-posed problem, The Cauchy-Kowalewski theorem for existence and uniqueness of solutions to PDE

- Hyperbolic PDE
  - Scalar first order Partial differential equations, Characteristics, Charpits method, Weak Solutions., Quasi-linear first order equations and quasi-Linear systems of partial differential equations, weak solutions, shocks and rerefactions, Burgers equation, non-uniqueness and entropy conditions, Wave equation

- Elliptic PDE
  - Solution of Laplace equation using separable variable technique, Fundamental solution, Mean value theorem., Strong Maximum Principle, uniqueness and regularity, Energy Methods, Sobolev spaces and Lax-Milgram lemma.

- Parabolic PDE
  - Solution of Heat equation using Fourier Transform method, Mean Value Theorem, Maximum Principle, Regularity, Uniqueness, Semigroup approach

Reference Books:

5. F. John: Partial differential equations
VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

IM 203: Functional Analysis
Syllabus to be offered at M. Sc. Industrial Mathematics Sem - II w.e.f. June 2010-11

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Metric Spaces
Metric space, Examples of Metric Space, Open sets, Closed sets, Neighborhood, Convergence, Cauchy sequence, Completeness, Completion of metric space.

Normed Spaces and Banach Spaces
Vector Space, Normed Space, Banach Space, Properties of Normed spaces, Finite Dimensional normed space and subspaces, Compactness and finite dimension, Linear operators, Bounded and continuous liner operators, Linear functionals, Linear operators and functionals on a Finite dimensional spaces, Normed spaces of operators, Dual spaces

Inner Product Spaces, Hilbert Spaces
Inner Product space, Hilbert space, Properties of Inner product Space, Orthogonal compliments and direct sums, Orthonormal sets and sequences, Series related to orthonormal sequences and sets, Total orthonormal sets and sequences, Representation of functionals on Hilbert spaces, Hilbert adjoint operator, Self adjoint unitary and normal operator.

Fundamental theorems for Normed and Banach spaces
Zorn’s Lemma, Hahn – Banach theorem, Hahn – Banach theorem for complex vector spaces and normed spaces, applications to Bounded linear functionals on C [a , b], Adjoint operator, Reflexive spaces, Category theorem and uniform boundedness theorem, Strong an weak convergence, Convergence of sequences of operators and functionals, Weak convergence, Open mapping theorem, Closed linear operators, Closed Graph theorem.

References:

IM 204: Numerical Linear Algebra
Syllabus to be offered at M. Sc. Industrial Mathematics Sem - II w.e.f. June 2010-11

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Vector and Matrix Norms:
Vector Norms, Matrix Norms, Convergent Matrices, Stability of Nonlinear Systems,

Iterative Methods and Condition Number
Introduction, Gauss-Jacobi Iteration Method, Gauss-Seidel Iteration Method, Convergence of Iteration Methods, Successive Over-Relaxation Iteration Method, Conjugate Gradient Method, Definition and Examples, Elementary Properties of $k(A)$, Sensitivity Analysis of Solutions of Linear Systems, Residual Theorem, Nearness to Singularity, Estimating $k(A)$,

Singular Value Decomposition
SVD Theorem, Algebraic and Geometric Properties of SVD, Determining the Rank of a Matrix Using SVD, Compression Using SVD, Pseudoinverse and the SVD,

Numerical Eigenvalue Problem

References:
VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

IM 205: Design & analysis of Algorithm
Syllabus to be offered at M. Sc. Industrial Mathematics Sem - II w.e.f. June 2010-11

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- **Logic**

Propositional and predicate logic, propositions, predicates and quantifiers, quantifier and logical operators, rules of inference, methods of proof and logical verification of computer programs.

- **Theory of algorithms**

Problems and instances algorithms, characteristics of algorithms, concepts of test data, efficiency of algorithms, theoretical, empirical and hybrid approaches to measure efficiency, time complexity, space complexity, asymptotic notations, solving recurrences using characteristics equations, examples of simple algorithm and their analysis.

- **Graph theoretic algorithms and computer programs**

Recap the concepts and definitions of graph and trees as data structure, some basic algorithms, representation of graphs, breath first search, topological search, heap sort algorithm connectedness and assumptions, Lattice theory, Boolean algebra.

- **Theory of Computation**

Models in computer science, finite state automata, their use and properties, Deterministic finite automata, non deterministic finite automata, regular languages and their unions, finite state transducers, Push down automata, context free languages, turning machine and computing by turing machines.

**References:**

   Elements of the theory of computation, Prentice Hall of India. 1996
2. V. Aho, J. E. Hoperoft and J.D. Vilman  
   The design and analysis of Computer algorithms. 1974
3. Thomas H. Cormen Leiserson and Rivest  
   Introduction to algorithm, Prentice Hall of India, 1998
**IM 206: Object Oriented Programming**

**With C++**

Syllabus to be offered at M. Sc. Industrial Mathematics Sem - II w.e.f. June 2010-11

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**Principles of object oriented Programming**

Procedure oriented Programming Vs object Oriented Programming, Benefits of Object oriented Programming

**Classes and Objects**

**Constructions and Destructions**

**Operators Overloading, Functional Overloading and Type Conversions.**

**Inheritance**

**Pointers**

Basis of Pointers, Pointer Arithmetic, Pointer Array, Call by reference in user defined functions, Pointer to function

**Files:**

Reading and writing from a file, Reading and writing Structures, Random accessing a file

**References:**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

IM 301: Applied Statistics

Syllabus to be offered at M. Sc. Industrial Mathematics Sem -III w.e.f. June 2011-12

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- **Probability:**

Basic concepts, Sample space, Discrete probability, Simple theorems on probability, Independence of events, Bayes theorem. Discrete and continuous random variables, Binomial, Poisson and Normal distributions, expectation and moments, Chebyshev's inequality, central limit theorem.

- **Statistics:**

Data analysis, measures of central tendency, measures of dispersions, curve fitting, regression, correlation, chi-square test of goodness of fit, contingency tables, confidence interval for mean, variance. One population case, two population case, testing of hypotheses, small samples and large samples, sampling techniques, Simple random sampling with and without replacement, stratified sampling.

control charts for variables and attributes, acceptance sampling by attributes, simple, double and sequential sampling plans, Design of experiments

- **Stochastic processes:**

Markov chains with finite and countable state space, classification of states, limiting behavior of n-step transition probabilities, Continuous Markov process.

**References:**


5. S.,P.Gorden and F.S. Gorden: Contemporary Statistics, a computer approach, 1994
IM 302: Integral equations

Syllabus to be offered at M. Sc. Industrial Mathematics Sem -III w.e.f. June 2011-12

Variational problems with fixed boundary

The concepts of variational parameter, and its properties, variational forms of functional form, function depends on Higher order derivatives, functionals dependent on function of several independent variables, variational problem in parametric forms, application to the problems of mechanics, variational problems leading to an integral equation or differential difference equations, theorem of Dubois’Reymond stochastic calculus of variation,

Variational problem with moving boundary

Functional of the form $I(y(x)) = \int_{x_1}^{x_2} F(x, y, y')dx$, variational problem with a moveable boundary for a functional dependent on two function, one sided variation, reflection and refraction of extremals, diffraction of light rays

Variational problem with subsidiary conditions

Constrains of the form, isoperimetric problems, problems of Mayer & Bolza, equilibrium problem for elastic bodies- castigliano’s principle, problems of electro static

References:

IM 303: Optimization

Syllabus to be offered at M. Sc. Industrial Mathematics Sem -III w.e.f. June 2011-12

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- Optimization problems in engineering and industries
- Optimization problem formulation
- Classification of optimization problem
- Classical optimization techniques: Single variable optimization, Multivariable optimization, Constraint optimization, Lagrangain multiplier method, Khun-Tucker conditions
- Single variable optimization techniques:
  - Bracketing method - Exhaust search
  - Region elimination method - Interval halving method, Golden section method
  - Interpolation method - Quadratic interpolation method
- Multivariable optimization techniques:
  - Univariate method
  - Direct Search method - Simplex search method, Powells conjugate direction method
  - Gradient base methods - steepest descent method, conjugate gradient method
  - Variable matrix method
  - Constraint linear optimization problem
  - Overview of linear optimization problem
- Sensitivity analysis
- Quadratic programming - Wolf's modified simplex method, Bailes methods
- Integer programming problem - Gomorys cutting plane method, branch and bound techniques

References:

4. B.E. Gillet : Introduction to Operation Research Computer Oriented algorithm
VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

IM 304: Fluid Dynamics

Syllabus to be offered at M. Sc. Industrial Mathematics Sem-III w.e.f. June 2011-12

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- Vectors and Tensors:
- Flow Kinematics
- Flow descriptions (Lagrangian, Eulerian, Material derivative)
- Motion of Fluid particles (rate of dilation, rate of shear, rate of rotation)
- Conservation Laws
- Reynold’s transport theorem
- Conservation of mass
- Conservation of momentum
- Conservation of energy
- Navier-stokes equation
- Non dimensionalization of the Navier-stokes equation
- Special form of conservation laws
- Euler equation for inviscid gas dynamics
- Parabolic boundary condition for N S equation
- Vorticity and Circulation
- The vorticity transport equation and Helmholtz’s vorticity.
- Kelvin’s circulation theorem.
- Potential equation
- Laplace Equation for irrotational flows
- Incompressible inviscid irrotational flows
- Velocity potential and stream function in 2d and 3d
- Complex velocity potential
- Simple planer flows
- Incompressible Viscous flows
- Boundary layer equations

**References:**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

IM 305: Modeling & Simulation
Syllabus to be offered at M. Sc. Industrial Mathematics Sem -III w.e.f. June 2011-12

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- Needs and Techniques of mathematical modeling: Idea of mathematical modeling, need for mathematical modeling, steps in mathematical modeling, Characteristics of mathematical modeling, Interpretation
- Models in mechanical vibration: Spring mass system, pendulum problems
- Models in population dynamics: One species model, logistic model, growth model in time delays, Predator-Prey models, Volterra-Lotka models
- Models of chemical processes, Electrical network and Diffusion processes
- Traffic flow models

COMPUTATIONAL MODELING

- Physical systems: System types and characteristics behaviour, Continuous-time, discrete-time and discrete-event systems, linear and non-linear systems
- Exploration of behaviour through simulation:

Developing simulations of dynamical systems using Matlab: representation and visualization of simulation experiments, analyzing behavioural characteristics for a range of classes of physical and computational systems e.g. Predator-prey models, evolutionary systems and cellular systems

References:

IM - 306 File Organizations and Database System
Syllabus to be offered at M. Sc. Industrial Mathematics Sem -III w.e.f. June 2011-12

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- Streams and Files
- Advantages of streams
- Stream class hierarchy
- The ios class
- The istream class
- The ostream class
- Stream errors
- Disk file I/O with stream
- File pointers
- Error handling in file
- File I/O with member function
- Overloading the extraction and insertion operators
- Memory as a stream objects
- Command line argument
- Creating Multi file programs

Reference:

1. C Programming Language - Karnighan & Ritchie - THM
2. 'C' Odyssey 6th Volume - Vijay Mukhi - PHI
4. Mastering Turbo C - Kelly and Bootle - BPS
5. C language Programming Byron Gottfried - THM
VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

IM - 401 Image Processing

Syllabus to be offered at M. Sc. Industrial Mathematics Sem -IV w.e.f. June 2011-12

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Introduction


Image Formations and Representation

Introduction, Image formation, Illumination, Reflectance Models, Point Spread Function, Sampling and Quantization, Image Sampling, Image Quantization, Binary Image, Geometric Properties, Chain code representation of a binary object, Three-Dimensional Imaging, Stereo Images, Range Image Acquisition, Image file formats

Colors and Color Imagery

Introduction, Perception of Colors, Color Space Quantization and Just Noticeable Difference, Color Space and Transformation, CMYK, NTSC or YIQ Color, YCbCr Color, Perceptually Uniform Color, CIELAB color, Color Interpolation or Demosaicing, Nonadaptive Color Interpolation Algorithms, Adaptive algorithms, A Novel Adaptive Color Interpolation Algorithm,

Image Transformations

Introduction, Fourier Transforms, One-Dimensional Fourier Transform, Two-Dimensional Fourier Transform, Discrete Fourier Transform (DFT), Transformation Kernels, Matrix Form Representation, Properties, Fast Fourier Transform, Discrete Cosine Transform, Walsh-Hadamard Transform (WHT), Karhunen-Loeve Transform or Principal Component Analysis, Covariance Matrix, Eigenvectors and Eigenvalues, Principal Component Analysis, Singular Value Decomposition

References:

IM - 402 Wavelet Analysis

Syllabus to be offered at M. Sc. Industrial Mathematics Sem -IV w.e.f. June 2011-12

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- From Fourier Analysis to Wavelet analysis
- Time Frequency Analysis
- Continuous Wavelet Transform
- Discretizing the Wavelet Transform
- Frames
- Frames of Wavelets
- A necessary condition (Admissibility of the mother wavelet)
- The dual frame
- Examples of Tight frames, The Mexican hat function, a modulated Gaussian
- Frames for the Windowed Fourier transform
- Time-Frequency Density
- Orthonormal Wavelet bases
- Multi Resolution Analysis
- Riesz bases of scaling function
- The Battle-Lemaire waveltes
- Regularity of Orthonormal wavelet bases
- Orthonormal Bases of Compactly Supported Wavelets with Examples
- Regularity of Compactly Supported Wavelets

References:

INTRODUCTION:

DISCRETE-TIME SIGNALS AND SYSTEMS:

THE Z-TRANSFORM:

SAMPLING OF CONTINUOUS - TIME SIGNALS:

TRANSFORM ANALYSIS OF LINEAR TIME-INVARIANT SYSTEMS:

References:
VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

IM 404: Computational Fluid Dynamics

Syllabus to be offered at M. Sc. Industrial Mathematics Sem -IV w.e.f. June 2011-12

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- Introduction to CFD, Applications;
- Governing equations and assumptions, Equation types, Model equations, potential flow, Heat conduction, Wave equation, Burgers equation, Euler equations.

References:

Definition and brief history of artificial neural networks.

- Structure and function of a Single Neuron, Biological Neuron and artificial Neuron Models
- Architectures and Neural Networks:
  - Fully connected
  - Layered networks
  - Feed forward
  - A cyclic and modular networks
- Supervized and Unsupervized networks
- Learning Algorithms:
  - Correlation learning
  - Competitive learning
  - Habbian rule
  - Perceptron rule
  - Delta rule
  - Back propagation algorithm.
- Hopfield Networks
  - Continuous and Discrete
  - Energy function and its properties
  - Capacity of Hopfield Networks.
- Radial Basis Function Networks, Cover’s theorem.
- Application of Neural Networks
  - Classification
  - Clustering
• Pattern association
• Function Approximation
• Forecasting
• Control application
• Optimization

**References:**

**Introduction**

Introduction to Matlab, variable and array, subarrays, displaying output data, data files operation on array, hierarchy of operation on array, built in function in Matlab

**Plotting**

Introduction to plotting, graph window, two dimensional plot, multiple plot, components of graph(legend, title,), graphical image, commet, 3D graph, additional plotting features Subplots, polar plots,

**Branching statement and program design**

The if construct, switch construct, The try-catch construct , relational operators, logic operators, logical functions

**Loops**

The while loop, The for loop, The break and continue statements, Nesting loops.

**User defined function**

Introduction to Matlab functions, variable passing in Matlab(pass by value), preserving data between calls to functions, sub functions, private function, nested function

**Practical based on image processing, wavelet, digital signal processing, neural network**

**References:**

2. Rudra Pratap: getting started with Matlab, oxford university press, 2004